

What Explains Growth and Inflation Dispersions in EMU?

Emil STAVREV (estavrev@imf.org)*

Abstract

This paper's analysis of growth and inflation dispersions in the euro area reveals several findings. First, these dispersions have declined appreciably since EMU. Second, the remaining dispersions are small but persistent, relating mainly to country-specific shocks, not differences in the transmission of common shocks. Third, the role of income convergence in explaining the dispersions has increased over time, while the role of price level convergence has declined. However, the increased role of income convergence should be viewed with caution, as it may reflect temporary rather than fundamental convergence factors, which may lead to growing macroeconomic imbalances.

1. Introduction

Growth and inflation dispersions in the euro area have declined since 1990 and are now comparable to those among US states, but they are longer-lasting (see, among others, (Giannone, Reichlin, 2006), and (Eickmeier, 2006)). As business cycles have become more synchronized since euro adoption, the contribution of the cyclical component to growth dispersions has declined. However, the contribution of the trend component has increased, partly as a result of different degrees of structural reform implementation among euro-area members (*Figure 1*).¹ The persistence of the remaining inflation dispersions has come with cost dispersions and diverging external positions (*Figure 2*). While temporary differences in inflation dynamics in a monetary union can be benign, e.g., reflecting income convergence or adjustment to country-specific shocks, they can also be associated with risks for future growth and incomes.

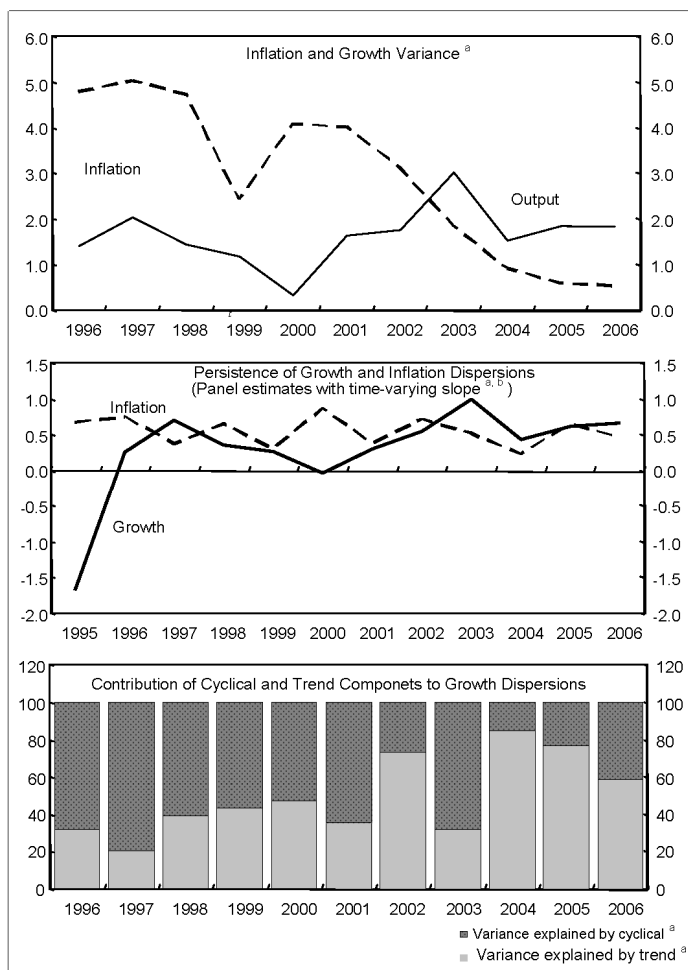
Accordingly, growth and inflation dispersions among euro-area countries have attracted the attention of researchers and policymakers. A better understanding of the factors behind growth and inflation dispersions is of particular importance from a policy standpoint, as it would allow us to distinguish between benign and malign economic developments in the European Monetary Union (EMU) member states.

The paper analyzes the factors behind EMU dispersions by using a variety of distinct approaches. First, it examines the contribution of country-specific versus asymmetrically transmitted common shocks in explaining the divergences. Second, it studies the role of convergence factors in growth and inflation heterogeneity in the EMU.

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¹ The following measures of EMU dispersions are shown in *Figure 1*: in the top panel – the unweighted inflation/growth variance for EMU member states excluding Luxembourg and Ireland; in the middle panel – a simple measure of inflation/growth dispersion persistence estimated by the time-varying autoregressive coefficient in a panel regression of inflation/growth dispersions; in the bottom panel – the shares of the cyclical and trend components of growth dispersions (the separation was done using the Hodrick-Prescott filter).

FIGURE 1 Euro Area: Growth and Inflation Dispersions



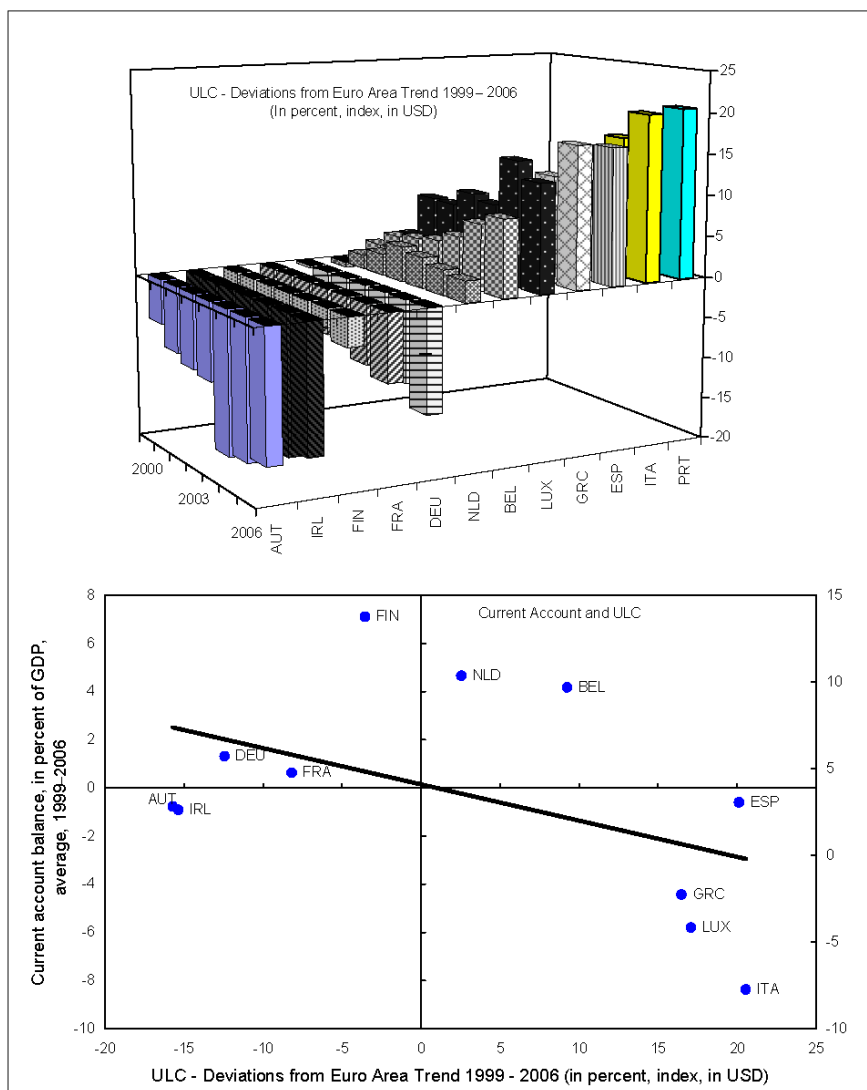
Notes: ^a unweighted variance, excluding Ireland and Luxemburg

^b estimated equation, $x_{t,i} - \bar{x} = \alpha_i + \beta_t (x_{t-1,i} - \bar{x}_{t-1}) + \varepsilon_{t,i}$ where: $x_{t,i}$ – growth/inflation of each member state; \bar{x} – Euro area growth/inflation; β_t – persistence parameter

Sources: IMF, World Economic Outlook

The analysis reveals several findings. First, growth and inflation dispersions have declined appreciably since the onset of EMU. Second, the remaining dispersions are small but persistent, relating mainly to country-specific shocks, not differences in the transmission of common shocks. Third, the role of income convergence in explaining the dispersions has increased over time, while the role of price level convergence has declined. However, the increased role of income convergence should be viewed with caution, as it may reflect temporary rather than fundamental convergence factors, which may result in growing macroeconomic imbalances.

FIGURE 2 Euro Area: Unit Labor Costs and Current Account



Sources: IFS; WEO database

The rest of the paper is organized as follows. Section II provides an overview of the findings in the literature. Section III describes the methodological approaches used in the analysis and discusses the results, while Section IV concludes.

2. Literature Review

Giannone and Reichlin (2006) find that business cycles are similar across EMU countries and movements in outputs are mainly explained by common shocks with similar propagation mechanisms, while idiosyncratic shocks are relatively small

but persistent and account for the bulk of euro-area dispersions. They also note that shock propagation is more persistent in the euro area than in the United States, but that cycles are less volatile. Eickmeier (2006) also finds that, in general, output and inflation responses to common shocks (demand, supply, monetary policy, and external) across euro-area countries are similar, but long-lasting idiosyncratic shocks are responsible for output and inflation variations across countries. Similarly, EC (2006) finds that country-specific shocks, including a fall in risk premia following the introduction of the euro, relaxation of credit constraints, and productivity in traded and non-traded goods are important explanatory factors for divergences.

Findings in the literature suggest that fiscal policy has contributed to the reduction of output volatility over time, but elements of procyclicality remain. In particular, Darvas and others (2005) find evidence that fiscal convergence (persistently similar GDP ratios of government balances) is associated with synchronization of business cycles. They also observe that the Maastricht fiscal criterion may have moved the EMU closer to an optimal currency area by reducing countries' scope to cause idiosyncratic shocks. Darvas and others recognize that by imposing convergence of budget deficits, the criterion could make fiscal policy less effective in counteracting asymmetric shocks, but the results suggest that the synchronization effect of fiscal policy has dominated.

3. Analytical Framework and Estimation Results

3.1 Common versus Country-Specific Shocks

The relative importance of common and country-specific shocks for inflation and growth was estimated using a bi-variate VAR for each country inflation/real GDP growth and euro area inflation/real GDP growth. Specifically, the two separate bi-variate VARs – one for inflation and one for growth – were defined as follows:

$$\begin{bmatrix} \bar{x}_t \\ x_t^i \end{bmatrix} = A_1 \begin{bmatrix} \bar{x}_{t-1} \\ x_{t-1}^i \end{bmatrix} + A_2 \begin{bmatrix} \bar{x}_{t-2} \\ x_{t-2}^i \end{bmatrix} + A_3 \begin{bmatrix} \bar{\varepsilon}_t \\ \varepsilon_t^i \end{bmatrix}$$

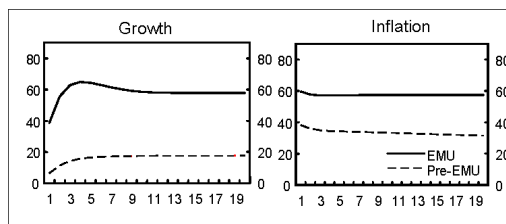
where \bar{x}_t is euro area growth/inflation, x_t^i is country i growth/inflation, $\bar{\varepsilon}_t$ is a common shock, and ε_t^i is a country-specific shock. The VARs were estimated with quarterly data for two periods – pre-EMU (1980Q1–1998Q4) and EMU (1999Q1–2006Q4). To identify the structural shocks, euro area growth and inflation were assumed to be affected by country-specific shocks with a lag.

The impact of common and country-specific shocks on growth and inflation was calculated using the estimated impulse response functions from the above VARs. The above systems can be rewritten in terms of the impulse response functions and the structural shocks, as follows:

$$\begin{bmatrix} \bar{x}_t \\ x_t^i \end{bmatrix} \approx \sum_j \begin{bmatrix} \phi_{11}(j) & \phi_{12}(j) \\ \phi_{21}(j) & \phi_{22}(j) \end{bmatrix} \begin{bmatrix} \bar{\varepsilon}_{t-j} \\ \varepsilon_{t-j}^i \end{bmatrix}$$

where $\phi_{11}(j)$ is the impulse response function of euro area growth/inflation to common shocks, $\phi_{21}(j)$ is the impulse response function of growth/inflation in each

FIGURE 3 Euro Area: Contribution of Common Shocks to Inflation and Growth, Pre-EMU and EMU (in percent)



Source: IMF Staff calculations

country to common shocks, $\phi_{12}(j)$ is the impulse response of euro area growth/inflation with respect to country-specific shocks, and $\phi_{22}(j)$ are the impulse response functions of growth and inflation in each country with respect to country-specific shocks.

The main findings from the estimation results point to significantly more euro-area member country integration since the start of the currency union. The contribution of common shocks to inflation and growth has increased since the introduction of the euro (*Figure 3*). While common shocks accounted on average for 20 percent of growth and 30 percent of inflation before the creation of EMU, their contribution increased to around 60 percent for both growth and inflation during EMU. Also, common shocks trigger increasingly similar responses across member countries.

Next, using the above shock decomposition, the contribution of country-specific shocks to growth/inflation dispersions is related to the estimated impulse response functions as follows:

$$\frac{[\phi_{22}(j) - \phi_{12}(j)]^2}{[\phi_{22}(j) - \phi_{12}(j)]^2 + [\phi_{21}(j) - \phi_{11}(j)]^2}$$

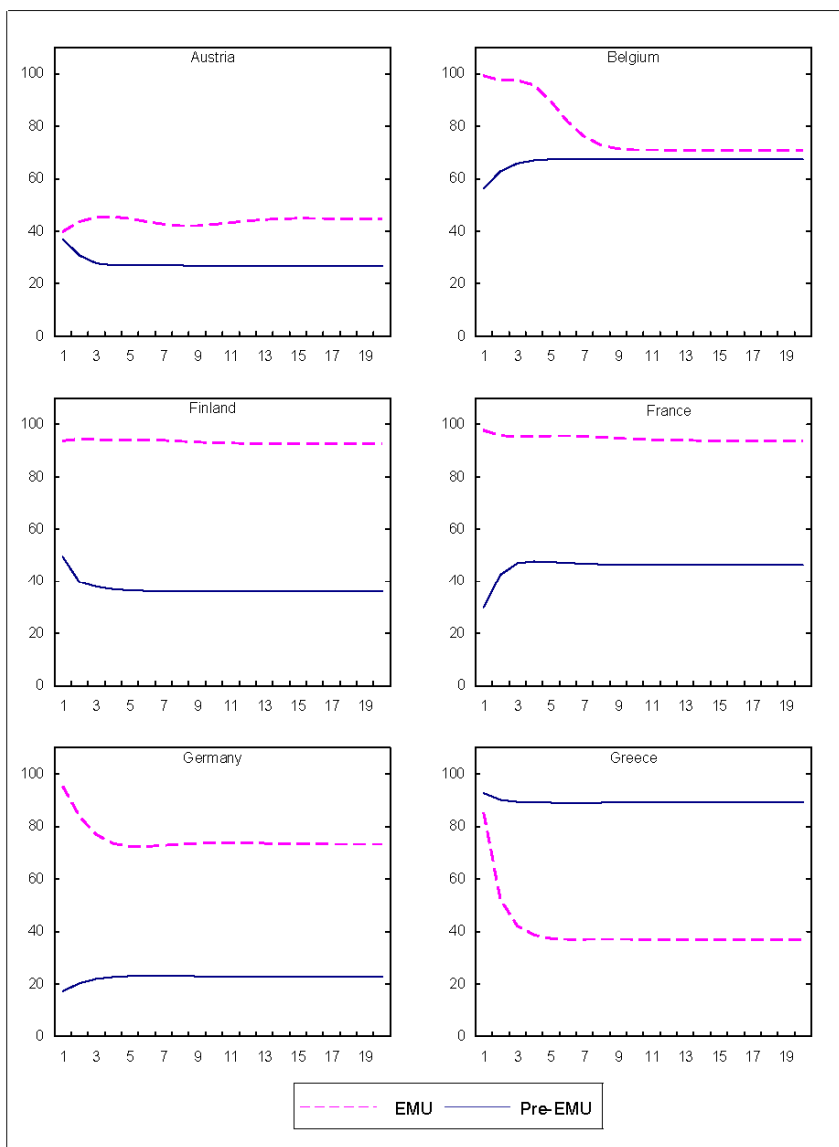
This relationship was used to calculate how much of the dispersions is due to country-specific shocks. The remaining growth and inflation dispersions have largely been driven by country-specific shocks since euro introduction, not by different country responses to common shocks. Country-specific shocks account for more than 70 percent of *growth dispersions* (with the exception of Austria, 45 percent, and Greece, 40 percent, *Figures 4a* and *4b*) and more than 75 percent of *inflation dispersions* (except Italy, 40 percent, *Figures 5a* and *5b*).

3.2 Country-Specific Developments and Income and Price Level Convergence

The impact of income and price level convergence on growth and inflation dispersions is assessed using two panel regressions:

- For *inflation dispersions*, $\pi_{i,t} - \pi_t^{EA} = \alpha + \gamma \log(P_{i,t0} / P_{t0}^{EA}) + \varepsilon_{i,t}$, where $\pi_{i,t} - \pi_t^{EA}$ is the deviation of inflation in each country from the euro-area average and $\log(P_{i,t0} / P_{t0}^{EA})$ is the deviation of the price level in a member country from the euro-area average at the beginning of the sample.

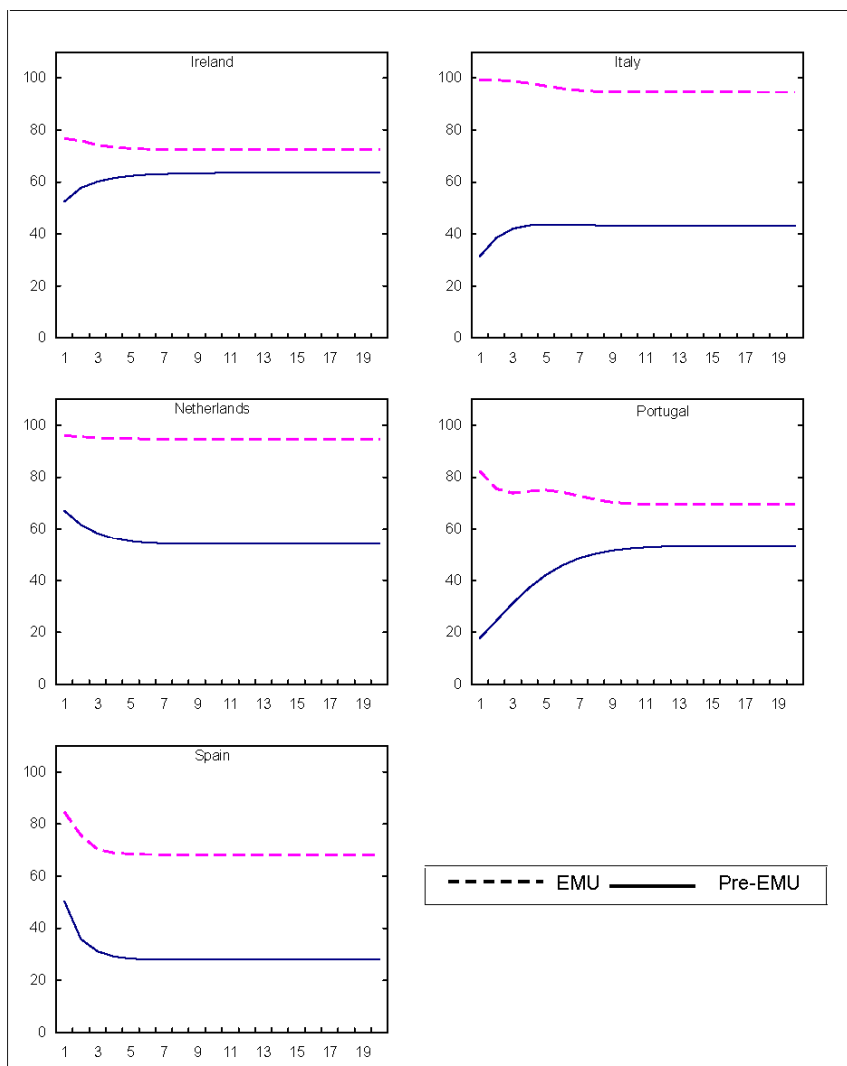
FIGURE 4a Euro Area: Contribution of Country-specific Shocks to Growth Dispersions, Pre-EMU and EMU (In percent)



Source: IMF Staff calculations

- For *growth dispersions*: $g_{i,t} - g_t^{EA} = \alpha + \gamma \log(YP_{i,t0} / YP_{t0}^{EA}) + \varepsilon_{i,t}$, where $g_{i,t} - g_t^{EA}$ is the deviation of output growth in each country from the euro-area average and $\log(YP_{i,t0} / YP_{t0}^{EA})$ measures the percent difference of member countries' per capita GDP from the euro-area average at the beginning of the sample.

FIGURE 4b Euro Area: Contribution of Country-specific Shocks to Growth Dispersions, Pre-EMU and EMU (In percent) – *concluded*

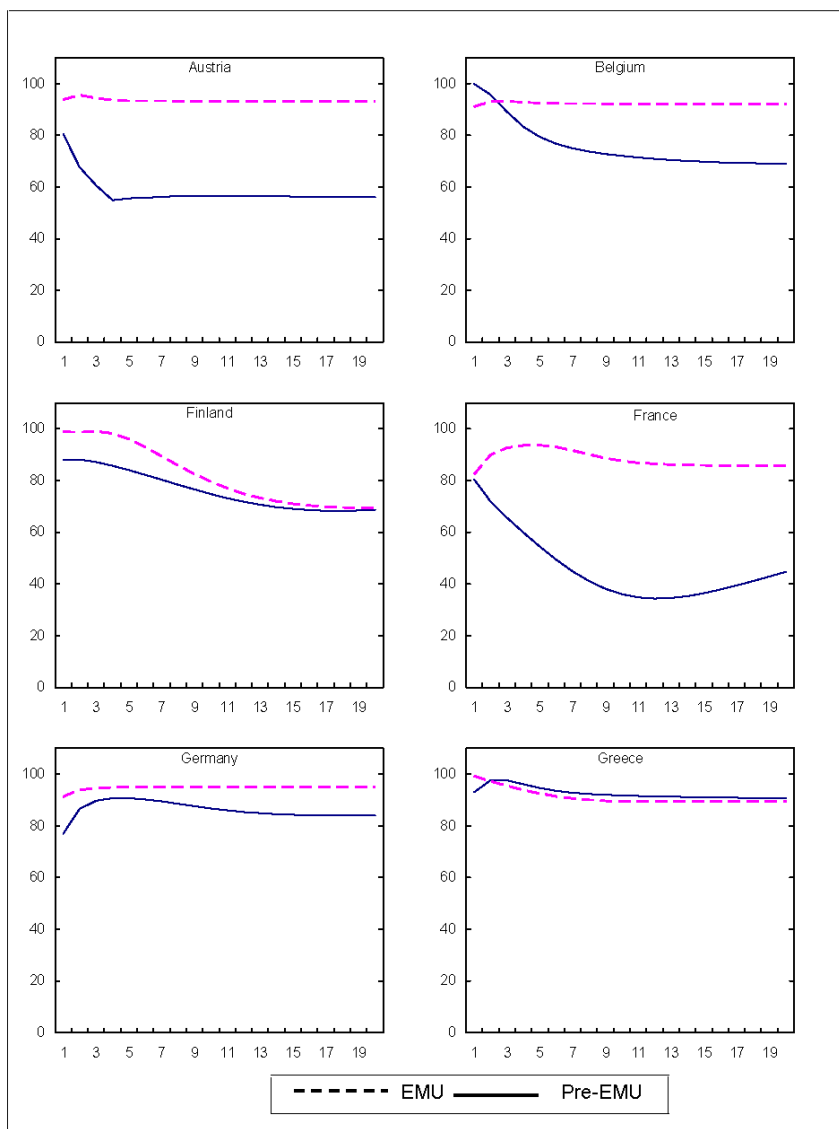


Source: IMF Staff calculations

The above equations were estimated for the EMU members excluding Ireland and Luxembourg over two sub-samples: pre-EMU (1980–1998) and EMU (1999–2006). The equations were estimated using fixed effects panel regression. We tested for robustness of the estimation results by varying the split-point of the sample to 1996 and 1997. The estimated speed of convergence for both growth and inflation did not change significantly.²

² The robustness check results using different sub-sample splits are available from the author upon request.

FIGURE 5a Euro Area: Contribution of Country-Specific Shocks to Inflation Dispersions, Pre-EMU and EMU (In percent)

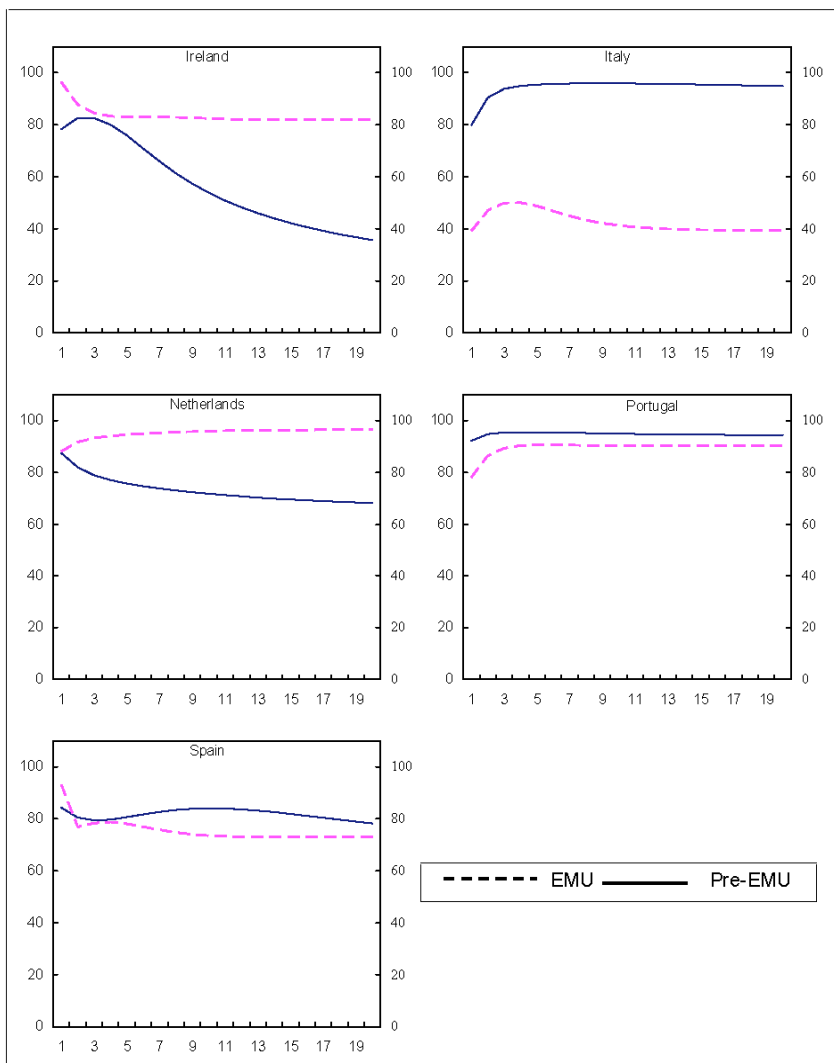


Source: IMF Staff calculations

The estimation results suggest an increasing importance of income convergence and a declining role of price level convergence in accounting for dispersions over time³ (Table 1). Price level convergence was associated with 60 percent of infla-

³ The estimated speed of income and price level convergence coefficients are significant at a 95 percent confidence level. The robustness tests show that changing the split-point of the sample does not significantly alter the results.

FIGURE 5b Euro Area: Contribution of Country-Specific Shocks to Inflation Dispersions, Pre-EMU and EMU (In percent) – *concluded*



Source: IMF Staff calculations

tion dispersions during 1980–1998, but this halved under EMU (to slightly above 30 percent of inflation dispersions). Findings elsewhere in the literature suggest similar results. For example, Rogers (2007) concludes that the price levels of traded goods in EMU converged mostly prior to euro adoption, with their dispersion thereafter being similar to that in the United States. At the same time, income convergence accelerated under EMU and accounted for a larger share of growth dispersions compared to the pre-EMU period. However, from a policy standpoint it is important to bear in

TABLE 1 Income and Price Level Convergence and Dispersions ^a

	1980–1998		1999–2006	
	Inflation	Growth	Inflation	Growth
Speed of convergence γ (Standard errors)	-0.47 (0.03)	-0.11 (0.06)	-0.42 (0.03)	-0.25 (0.07)
Adjusted R^2	0.60	0.01	0.31	0.12

Note: ^a impact of 10 percent price/income level difference from euro area average on inflation/growth dispersions, in percentage points

TABLE 2 Persistence of Inflation and Growth Dispersions ^a

	1980–1998		1999–2006	
	Inflation	Growth	Inflation	Growth
Speed of convergence γ (Standard errors)	-0.4 (0.01)	-0.8 (0.03)	-0.3 (0.01)	-0.2 (0.02)
Long-term $\gamma / 1 - \rho$	-1.2	-1.3	-0.5	-0.3
Adjusted R^2	0.9	0.2	0.7	0.6

Note: ^a Lower coefficient in absolute terms means higher persistence.

mind that “accounting for” does not mean “causing”. Accordingly, temporary rather than fundamental convergence factors could also explain the remaining growth and inflation dispersions.

3.3 Persistence of Country-Specific Developments

The persistence of the remaining growth and inflation dispersions is estimated using the following panel regression:

$$x_{i,t} - x_t^{EA} = \alpha + \rho (x_{i,t-1} - x_{t-1}^{EA}) + \gamma \log(X_{i,t-1} / X_{t-1}^{EA}) + \varepsilon_{i,t}$$

where $x_{i,t} - x_t^{EA}$ is the deviation of inflation/growth in each country from the euro-area average and $\log(X_{i,t-1} / X_{t-1}^{EA})$ is the deviation of the price level/PPP GDP per capita in a member country from the euro-area average. The coefficient γ in the above equations captures the persistence of the dispersions, with a lower value of the coefficient in absolute terms corresponding to slower adjustment.

The estimation results imply that persistence of inflation and growth dispersions has increased under EMU (*Table 2*). Although the above framework does not identify the sources of the persistence in the inflation and growth dispersions, aside from convergence factors another reason could be different degrees of structural reform among the euro-area members during EMU. In particular, ECB (2005) finds that services prices and differences in wage developments have been major sources of inflation persistence and, as a result, of the persistence of inflation dispersions.⁴

4. Conclusions

Euro-area members share common shocks and their contribution to growth and inflation has increased since EMU, but dispersions remain. The results of this paper

⁴ Indeed, consistent with the significant impact of services prices and wages on EMU inflation dispersions is the noticeable difference in the degree of structural reform in both services sectors and labor markets among euro-area members over the past decade.

suggest that inflation and growth in the EMU countries are to a large extent driven by common shocks, the importance of which has increased over time. This suggests that the common monetary policy may have contributed significantly to business-cycle synchronization and stabilization, as might better synchronization of fiscal policy. In particular, while common shocks explained around 30 percent of growth and inflation in the euro-area members before the introduction of the euro, their contribution increased to around 60 percent after that. At the same time, common shocks increasingly trigger common responses. Accordingly, their contribution to dispersions has declined. This is important not least because it suggests that the potential for monetary policy to efficiently and effectively address common shocks has increased. The remaining dispersions are predominantly driven by country-specific shocks.

The persistence of idiosyncratic shocks raises the importance of facilitating adjustment to shocks. The functioning of the labor and product markets could be improved to foster better operation of the competitiveness channel and higher productivity growth. The latter would facilitate faster adjustment during downturns, given downward nominal wage rigidity. Fiscal policy in the member states could absorb idiosyncratic shocks by allowing automatic stabilizers to work (see (Eichengreen, Wyplosz, 1998)).

Several factors have contributed to the idiosyncratic shocks that drive the remaining dispersions. One factor has been income and price level convergence. This factor could account for over 30 percent of the remaining inflation dispersions and has gained importance in the growth dispersions under EMU. It will persist, but its force will diminish. Another set of factors, which is not necessarily orthogonal to the first one, has been EMU-related changes in interest rates and house price developments. This could account for 40 percent of the growth divergences and may largely be of a one-off nature (see (Stavrev, 2008)).

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